EYE AND FACE PROTECTION

Most used glasses:

- Safety glasses
- Monogoggles
- Glasses for protection against x-radiation, laser radiation, ultraviolet, infrared and visible radiation
- Face shields
- Welding helmets and hoods (held by hand, with headband or possible to mount to a safety helmet)

Safety glasses

The glass in safety glasses is required to be made of hardened glass or plastic and the frame has to be made of metal or plastic. Both have advantages and disadvantages. Safety glasses have to be selected based on the temperature of the work environment and how scratch proof the lenses have to be.

Several norms for safety glasses:

- NEN-EN 166: demands and specifications of lenses and frames
- NEN-EN 169 and 379: welding
- NEN-EN 170: UV filters
- NEN-EN 207 and 208: laser radiation

HAND AND ARM PROTECTION

- Gloves. To use to, for example:
- protect against chemical and biological influences;
- protect against cold or heat.
- protect against mechanical influences (stabbing and cutting objects, vibrations, etc.);

Chemical/biological substances:

The durability and permeability of gloves vary greatly, depending on the material of which the gloves are made. If the gloves are made of the right material, they will offer sufficient protection against most chemical substances. The *chemiekaartenboek* (book of material

safety data sheets, published by TNO Arbeid and Samson) states the recommended materials per chemical substance. Most suppliers will also provide sufficient information about the degree of protection and permeation time. For a global overview, see the table on the next page.

If you are working with biological material (blood, microorganisms and the like) wearing gloves is often a requirement. In these cases it is again important to know the amount of protection a glove offers.

Material	Protection against	Note
Natural rubber (latex)	Soaps and detergents, water-soluble Not suitable for organic irritating agents, diluted acids and alkalis	solvents, strong acids and alkalis, permeable for nickel.
Butyl rubber	Acid-resistant, acrylates (except butyl acrylate), isocyanides	
Chloroprene	Soaps and detergents, diluted acids and alkalis, amines, esters and alcohols	Flexible, tears easily. Not suitable for Aldehydes, ketones, halogenated compounds.
Fluorocarbon (viton)	Organic solvents, primarily halogenated and aromatic hydrocarbons.	Expensive.
Nitrile rubber	Aliphatic solvents, vegetable oils	Tough material
Styrene-butadiene rubber		only hypoallergenic surgical gloves
Polyvinyl alcohol	Various organic solutions such as trichloroethylene, toluene.	No resistance against water or watery solutions.
Polyvinyl chloride (PVC).	Soaps and detergents, oils, fluids for metalworking, diluted acids and alkalis, vegetable oils.	Not suitable for most organic solvents. Not elastic.

GLOVES AGAINST COLD

In case there is a chance of freezing by liquid nitrogen, the only type of gloves that almost exclusively qualify are special cold-insulating gloves.

GLOVES AGAINST HEAT

Radiation heat: metallized cotton fabric protects against this. If there is also a risk of flames and sparks, you can apply impregnated wool or glass fibres, if necessary with a metallized surface.

Contact heat up until 350° C: wool (knitted and impregnated or not), cotton (raised fabric), acetate, terry fabric. A metallized surface serves no purpose here. These gloves are required to have a gauntlet that covers the entire wrist. The wearer should be able to shed them with a simple hand gesture.

MECHANICAL INFLUENCES

Special gloves exist for handling heavy and rough objects, though leather gloves are quite suited to the task as well. Gloves with increased resistance were developed against chafing, cutting and stabbing. A metal glove is special glove made of linked rings (chain mail). There are also gloves made of knitted supple metal wire.

SEVERAL NORMS FOR GLOVES

- NEN-EN 374-x: chemical substances and microorganisms
- NEN-EN 388: mechanical dangers
- NEN-EN 407: heat and/or fire
- NEN-EN 420: general
- NEN-EN 511: cold

HEARING PROTECTION

- Earplugs.
- Earmuffs
- Earmoulds

There are two types of protective gear: internal and external protective gear. Internal protective gear includes earplugs, ear protective wadding and earmoulds. External protective gear includes earmuffs and hearing helmet.

A comparative overview can be found below:

	1	2	3	4	5	6
Certainty of protection	+	+	+	-/+	-/+	++
Comfort	-	-	-/+	-/+	-/+	+
Applicability	-	-	+	+	+	#
Ease of use	+	+	-	-	-	++
Willingness to use	-	-	+	+	-	++
Costs	-	-	++	++	++	--
Costs per day**	+	+	-	-	-	+
Maximum amount of muffling (in dB)	15 - 25	15 -25	5 - 10	10 -15	10 - 15	15 - 25(#)

Explanation of the numbers in the table:

1 = earmuff, foam ring 4 = earplug

2 = earmuff, fluid ring 5 = glass down earplugs (properly applied)

3 = earplug (with string if necessary) 6 = earmoulds

* Costs:

- Denotes that the price of purchase is higher than 20 euros

-- Denotes that the price of purchase is 65 euros or higher

++ Denotes that the price of purchase per piece is between 20 and 30 cents

** Costs per day:

- Denotes that the costs per day are relatively high and that the articles are consumables.

+ Denotes that the costs per day are small due to relatively long depreciation costs.

Due to the options and/or adaptability with regards to the required muffling, the applicability is very large.

Explanation earmoulds:

Earmoulds are personal protective gear against harmful noises that are completely custom-made and adapted to the circumstances in which the protection is needed. The consist of an earpiece, equipped with an acoustic channel. This channel is fitted with a filter which muffles the frequencies in the audible area to a greater or lesser extent. Measuring someone for earmoulds is the work of a specialist.

It is very important to select the right filter. A filter that is too light will insufficiently muffle the sound. In addition, it is important to periodically test the earmoulds for how well they seal the ear. An earmould that does not fit perfectly can offer a 'false sense of security'. The user cannot personally correctly assess whether the earmoulds are functioning properly. It is important to realize that the earmoulds are less suited to brief periods of use (dirty fingers while putting in or taking out the earmoulds, easy to lose).

Several norms for hearing protection gear

- NEN-EN 548
- NEN-EN 352 1 to 3